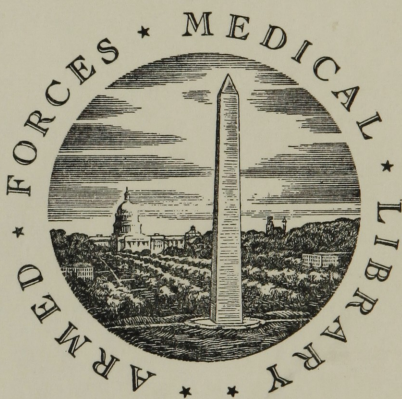


UNITED STATES OF AMERICA



FOUNDED 1836

WASHINGTON, D.C.

To Mr. Eliot
by the author

AN
ORATION,
ON
CHEMISTRY AND BOTANY;

DELIVERED BEFORE THE
Phi Beta Kappa Society,
AT NEW HAVEN,

DEC. 9, 1802.

BY DR. ELI IVES, A. M.

Published by order of the Society.

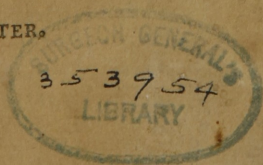


NEW HAVEN:

PRINTED BY JOEL WALTER.

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1803.



AN ORATION

DELIVERED

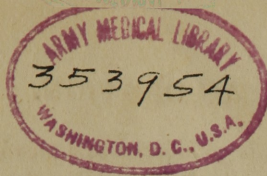
At the public request of a large
of scholars and country, among the members of the
Academy, that an annual oration was instituted.

The title of addressing you, which has been chosen
for me, I come to fulfill, by making a few observations upon
natural philosophy. I shall confine my observations to
chemistry and botany, parts of natural science which
have indeed been too much neglected by the learned in
this state, although they have been cultivated with great
industry by the philosophers of Europe.

No apology is necessary for addressing this to you, in
on the science of chemistry, since this science is made
a part of a liberal education in most of the universities
of Europe; and thus a great part of the learning of the
young is employed in the advancement of this science.

Chemistry is one of the properties of all natural bodies
and the science of their properties in different
circumstances, and the science of the effects of heat
and affinity upon all bodies.

No part of natural history is so interesting as chemistry.



AN ORATION.

GENTLEMEN,

IT was for the laudable purpose of exciting a spirit of emulation and enquiry, among the members of this society, that an annual oration was instituted.

The task of addressing you, which has devolved on me, I come to fulfil, by making a few observations upon natural philosophy. I shall confine my observations to chemistry and botany, parts of natural science which have indeed been too much neglected by the learned in this state, although they have been pursued, with great industry, by the philosophers of Europe.

No apology is necessary for addressing this society upon the science of chemistry; since this science, is made a part of academic education in most of the universities of Europe; and since a great part of the learning of Europe, is employed in the advancement of this science.

Chemistry treats of the properties of all material substances, and the changes of those properties in different circumstances; as it is the science of the effects of heat and affinity upon all bodies.

No part of natural science promises greater utility to

man, whether it is considered as a pleasing employment for the mind, as immediately applicable to every economic art, to the science of medicine, or to the explanation of the phenomena of nature.

In exhibiting a few of the principles and improvements of chemistry, it is not my object to build it upon the ruins of any other science. All the sciences are mutually dependent and connected, by a common bond. There is but one great system of mind and matter; but one great first cause, who has formed this system, and who regulates it by his uniform providence; or rather whose providence is this system. To understand this system, the knowledge of its parts are essentially necessary. The science of chemistry, as an important part of this system, particularly claims our attention. Chemistry was introduced into Europe by the conquest of the Arabians. From avarice and a fondness for mystery, which was peculiar to the dark ages, it received some slow and obscure improvements. Of this period it is sufficient to observe, that the ignorance, superstition and credulity of the Europeans, influenced them in philosophy as well as in politics and religion. The same extravagant spirit, which roused all Europe in defence of an empty sepulchre, afterwards manifested itself in the pursuit of the alkahest, the philosophers stone, the transmutation of the baser metals into silver and gold, and an universal medicine. The remains of the same spirit are now exhibited in our newspapers and apothecaries shops, under the title of *sovereign remedies, infalible balsoms, balms of Gilead*, and a long list of patent medicines, which promise eternal youth and vigor to their purchasers.

The history* of the origin of chemistry, is useful on-

* For the history of chemistry, see Boerhaave's chemistry.

ly to prove how slow, laborious and uncertain, is the advancement of the human understanding, unless aided by the correct results of observation and an unprejudiced love of truth. Chemistry remained a mere collection of facts, until the last century. It then received great improvements from the philosophical experiments of Boyle, Hales, Scheele, Ingenhouze, Bergman, Priestley, Black, Watson, and many others. But to the united exertions of Morveau, Berthollet, Fourcroy, Chapial and Lavoisier, the world is indebted for the present system of chemistry—A system which is not inferior to that of Newton, in the simplicity and demonstrability of its first principles, or the uniform application of those principles, to the explanation of the phenomena of nature. The nomenclature of this system, beautifully exhibits the connection, which exists between language and logic. To simple substances arbitrary names are given, to compound substances are given names significant of the parts of the composition and modes of combination. The inventors of the new system, in every instance, submitted their reasonings to the test of experiment, and never searched for truth, but by the natural road of experiment and observation; as mathematicians obtain the solution of a problem, by the mere arrangement of data, and by reducing their reasoning to such simple steps, and to conclusions so very obvious, as never to lose sight of the evidence by which they are guided.

Many are the discoveries of chemistry, both in the sublime and useful parts of philosophy. It teaches us a new principle of attraction, the attraction of affinity*.

* Affinity, or elective attraction, is a tendency which bodies have to unite and form a third substance, whose sensible properties are unlike either body. Sir Isaac Newton formed the first table of affinities; which is now to the chemist what the logarithmic tables are to the navigator.

The laws of affinity, though more numerous and complicated, are not less uniform in their operations, than the laws of gravitation. In addition to all those parts of matter, which are subjected to the laws of gravitation, to the laws of affinity, are subjected light and caloric. The existence of all the solid and fluid bodies in nature, which are not elementary substances, depends upon the principles of affinity; without which, the world would be as in the creation, without form and void. By the knowledge of the laws of affinity, we decompose bodies, and of their constituent elementary parts, produce a new creation. From analysis it is demonstrated, that atmospheric air consists of the same elements, as that powerful fluid formerly called aqua fortis. The difference of the sensible properties of those two substances, depends entirely upon the different state of affinity.

Astronomy, and the higher branches of the mathematics, are made a part of education, not on account of their being applicable to the purposes of life, but because by their study is acquired an accurate method of thinking. Like the mathematics, chemistry teaches an accurate mode of reasoning, and from the extensive views of the laws of nature expand the mind.

Among the discoveries of modern chemistry, none is more important, or leads to more interesting facts, than that of the composition of our atmosphere. Long had it eluded the research of philosophers, until the present analytic mode of reasoning was introduced into chemistry. This discovery was made after a series of accurate experiments, by the unfortunate Lavoisier. Previous to the discovery of the atmospheric air, was that of pure air, which was made almost at the same time by Lavoisier, Priestley and Scheele. To these succeeded the discoveries of the composition of water, of the operations

of combustion, of the bases of the acids, of vegetation and of animation, so far as it depends upon respiration.

No sooner were the properties, and modes of combination of pure air known, than the principles of the oxygenation of the blood were established. It is now ascertained that life is literally a flame, supported by a slow combustion of our atmosphere. The discoveries of the composition of our atmosphere, and the effects of different airs upon the human constitution, have roused the attention of philosophers, in every part of the world. Davis, Girtanner and Beddoes*, with rapid strides through the path of science, have promised to open a new æra, and expel disease from man. There are enthusiasts and fanatics, among philosophers, as well as among sectaries. A science may be as much degraded by assuming fanciful theories, as by the effects of ignorance. The German philosophers, who formerly pretended to explain the cause of a phenomenon, without having previously ascertained its existence, were no less ridiculous, than some new theorists, who have attempted to solve certain problems, by words† which have no definite ideas annexed to them, and by principles utterly inapplicable. False theory is not peculiar to chemistry, it is to be found in every department of science. The prediction of Newton, when he observed, "if the particles of air, should come in contact, they would be converted into marble," has been verified, by the discoveries of modern chemistry. Our atmosphere is indeed the reservoir of the elementary particles of all bodies. And marble is but a composition of fixed air, or carbone and lime, which is

* Honor is due to these philosophers, for several important discoveries, both in medicine and chemistry.

† How many new theories have been formed and how many old ones said to be destroyed by the word electricity?

probably a composite body. By analysis and synthesis, are shewn the conversion of airs into plants, plants into animal matter, and animal matter into plants, and the original elements. Vegetable analysis constantly exhibits three elements. Two of them, the component parts of water, oxygen and hydrogen, and those two a solvent for the third, which is carbone. In exhibiting the phenomena of the life of plants, and the mechanism of their compounds, is shewn that vegetable life, is merely a succession of chemical powers and attractions. Such a series of facts, founded upon the most correct experiments, explaining the nutrition of plants, will establish a rational system of agriculture, and lead to important improvements in that most useful art.

The different airs are only a modification of solid matter, combined with caloric, and according to their different affinities, are capable of assuming a concrete form, and being united to the most fixed bodies in nature.

The discovery of the properties of airs, was followed, by that of the beautiful process in nature, the purification of the atmosphere, by means of the respiration of plants. All parts of creation mutually labor, for the support and perfection of each other. Whatever element is rejected from the laboratory of one organized body, becomes the food of another part of creation. It was discovered by Dr. Priestly, and since supported, by the experiments of Count Rumford, that plants constantly emit pure air; but from a series of accurate experiments, Professor Woodhouse has proved, that plants emit pure only when supplied with fixed air.

The most surprising effects, to be reckoned among the laws of nature, are produced by chemical substances. Among which are the fulminating gold, silver and mercu-

ry, the spontaneous combustion of phosphorus and pyrophorus, at the common temperature of the atmosphere, and the hyper-oxygenated muriate of potash. Three grains of the latter substance, by trituration, produce an explosion truly astonishing. By the union of two cold fluids, is produced a rapid and instantaneous combustion, almost inextinguishable. By the combustion of two simple airs, hydrogen and oxygen is produced a bright flame, and a heat sufficient to melt platina. The formation of meteors, and the spontaneous combustions, which cause volcanic eruptions, are imitated and explained by the chemist. A catalogue of experiments, might be swelled to a volume, every one of which would exhibit an interesting fact, or establish some law of nature. From exhibiting and explaining the sublimest parts of nature, chemistry condescends to direct and explain even the culinary art.

Chemistry no longer, as in the dark ages, imposes upon the credulity of the ignorant. It no longer attempts to astonish the simplicity of the vulgar; but is content to explain the sublime appearances and habitude of matter, upon sound principles of philosophy, and to advance the true interest of man, by improving the useful arts and manufactures.

From the numerous improvements and discoveries, which the arts have received, within a few years, from chemistry, I shall name a few.

It has long been a desideratum, with chemists, to convert that part of our fuel, which is lost in soot, into light and heat. The object has been obtained, by the invention of the thermo-lamp*, by Citizen Leban. By this

* See Med. Repos. vol. V.

apparatus, the hydrogen of the smoke is conducted, in a moment, from one apartment to another, where it emits a mild heat, and a bright flame, without leaving either soot, ashes or coals. The discovery was made from the analysis of wood, the result of which is one sixth carbon and five sixths smoke, a great part of which is hydrogen or inflammable air.

Guided by analysis, the ingenious Clouet has discovered a process, for manufacturing steel of a superior quality, by a direct composition of clay, iron and carbon.

The analysis of mineral waters has been an object which has long engaged the attention of philosophers. From the experiments of Mr. Boyle it received its first improvements. Within a few years, it has been brought to perfection, by the celebrated Bergman and other German chemists; and is now deservedly ranked among the improvements of analytic science. These medicines of nature may be compounded in places most distant from those laboratories of nature where they were first formed.

By analysis, wool gives nearly the same result as oil. Guided by this fact Professor Chaptal has discovered a process for manufacturing soap, from useful articles of woollen, and an alkaline lixivium. No inconvenience has followed from the introduction of this economical process to manufacturies of cloth. There is scarce an art or manufacture, which has not, or is not, now receiving improvements from this science.

By the introduction of the oxygenated muriate of potash to bleaching, the process has facilitated and shortened to a surprising degree: This discovery, the honor

of which has been given to Berthollet, has been already adopted, by the linen manufacturers throughout Great Britain and France.

Seguin has accurately demonstrated the theory of tanning, and made important improvements in that art, which he has communicated to the public, with a liberality which does honor to himself and to science. Painting has received valuable acquisitions from Mexime. And the art of dying is found to consist in a simple principle of affinity. It is no other than a coloring substance, and a substance called a mordant, which by its affinity, attaches the color to the cloth.

During the late war in Europe, this science relieved the wants arising from scarcity. In England, the vegetable substance or gluten, which resides in bran, was converted into bread. And in France, substances, which were not before known to be nutritive, were converted into wholesome diet.—Such are the improvements, which necessarily follow the knowledge of the component parts and principles of affinity of material substances.

To shew the connection of chemistry, with all the arts and sciences, and to shew the improvements which have flowed from this connection, would require the numerous volumes, which are constantly published upon the subject.

No department of human knowledge, has received so great benefit from chemistry, as the profession of medicine. From physicians chemistry had its origin, and for many centuries, was considered as a mere appendage of their profession. There is indeed, a connection between chemistry and physic ; and no physician can be a thorough scholar in his profession, and be unacquainted with chemistry. Respecting the acquisitions of the healing art,

from this science, I shall only generally observe, that for the present improved state of physiology and pharmacy, we are indebted to chemistry, and that the most powerful articles of the *materia medica*, are creatures of the laboratory*. By the German and French chemists, every part of the human body has been subjected to accurate analysis; and the elementary parts and mode of composition ascertained. So many important facts promise great improvements to the healing art. Already has chemistry, to a good degree, swept away the dregs of quackery and ignorance. No longer, do the arts wait the slow improvements of blind chance. They are now pursued, upon philosophical principles. It is probable, that within a few years, many of the necessities and luxuries of life, will be made by a direct composition, instead of waiting the slow process of nature. Indeed, whole animal bodies have been converted into oil, by the abstraction of their azote.

Chemistry has received the addition of a new electrical fluid, the laws of which constitute that part of chemistry, entitled Galvanism. This discovery, the honor of which, ought rather to be given to Volta, than to Galvani, has already been successfully applied to the cure of diseases, and promises to solve some parts of nature, which have hitherto eluded the research of philosophers. To this part of chemistry is probably reserved, to explain the connection, which exists between mind and matter.

No part of science, within twenty years, has received so great improvements as chemistry. The rapid pro-

* Animal Chemistry, see the 9th and 10th vols. of A. F. Fourcroy's works.

gress of this science, since the adoption of the new system, and the present competition of its votaries promise to carry it, within a few years, to its ultimate point of perfection. Our country may already boast, of a long list of chemists, the number and accuracy of whose experiments, are not inferior to those of European chemists; and who are ardently engaged, in the advancement of this science. Among whom, are Priestley, Woodhouse, Mitchel, Maclean, Pascalis, and the late President of the Medical Society of Connecticut.

The other part of natural philosophy, upon which was proposed to make a few observations, is botany; a part of science not less pleasing, though more neglected by our citizens, than any other of the whole circle of the sciences. This branch of knowledge, is recommended by the example of Solomon, who is recorded to have written of all the plants, from the cedar of Lebanon, to the hyssop upon the wall. The ancients were perhaps as well acquainted, with the virtues of plants, as the moderns; but their discoveries are in a great measure lost to us, for want of an accurate system of description and classification. This defect has been supplied, by the labors of Turnfort, Ray, Boerhaave, Linnæus and Miller, who have given to botany, a system, which has deservedly ranked it among the sciences.

In many parts of science, America is not inferior to the most enlightened countries of Europe. The genius and enterprise of our citizens are not inferior. Yet however degrading it may be to our national pride, it is a fact undeniable, that we are dependent upon the Europeans, for the knowledge of the plants of our own country. No part of the globe abounds, with so great a variety of botanical productions, which from their magnitude, number

and surprising effects upon the human constitution, prove in the vegetable, as the mammoth in the animal kingdom, that nature has not belittled her productions in America.

There are constantly imported, into our country, at a great expence, vegetable productions, which grow in wild luxuriance, in almost every part of it. The productions of our country may be obtained without the loss of their essential properties by time or adulteration.

Germany, England and France have sent botanists, into our country, to discover the treasures of our forests. These botanists have carried home some of the plants, which are peculiar to this country, and are now publishing their virtues* and classification.

Botanical gardens were established in the states of New-York and South-Carolina, by the late king of France. The botanist whom he sent, was the learned Michaux, at present a member of the National Institute, and a botanical missionary to the south seas. The discoveries of a ten years residence of this philosopher, which were the last year published in Paris, are truly worthy national attention.—Much good is done in this way, at a very trifling and insignificant expence. For this compensation, however small, the botanist transmits to the country which sent him, the vegetable productions of all kinds, at once gratifying national curiosity, and enriching his native land, with the useful species of the remotest islands and provinces of the earth.

While our native citizens have been ignorant or incurious of the treasures of the forests, the industrious bo-

* The French botanists have published a course of experiments, made with the *rhus toxicodendron*, a plant peculiar to this country.

tanists, from foreign countries, discover, describe, and teach us how to know them.

Not a single botanical garden has been established in America, by any authority of our country, either political or academical. We trust that this reproach, will not long be attached to our country. Even in this State, which has been stiled the Athens of America, botany has been most neglected. Scarce a naturalist is here to be found, who can point out the generic difference of our plants, by their gender and their specific difference, by their foliage and fructification. I know not that a botanical work has been published, by a native American, save that of Professor Barton, whose talents and industry promise to take from our country, the reproach arising from the neglect of this part of science. That part of botany, which treats of the virtues of plants, has been entirely neglected. Already has America produced a bark, which has removed the fatality of that disease, which in less than forty years, deprived Britain of two of her monarchs.* And the properties of a root have been discovered by Dr. Archer, which has proved a successful remedy against a disease, upon which European authors were either silent, or which they confessed that they could not cure.

Notwithstanding the botanical discoveries which have been made by Europeans, an unlimited field still lies open for the display of genius and enterprize. Our country every where, abounds with vegetable productions, the properties and description are yet in reserve, for the dis-

* James the first, and Oliver Cromwell, both died of the intermittent fever.

† See Archer's Treatise on the origina trachealis.

covery of the Americans. It is worthy of remark, that many of the philosophers of our country are turning their attention to this branch of useful knowledge.

Why a science should be so much neglected, the study of which so beautifully exhibits the perfect order and inimitable works of the Deity, in the vegetable kingdom, remains yet to be accounted for. There must be powerful reasons, which have induced our citizens, to be indifferent to the discoveries, in natural science; strong reasons, which have prevented them from sharing the honor of discoveries so important.

Among others, the following reasons have undoubtedly had their influence.

A fondness for political preferment, which has pervaded every class of society; the desire of honor, which has been attached to wealth rather than literary attainments, and party politics, which have taken place of every department of science. Party politics, which have inclined our citizens to depend upon interest or influence, for honors and emoluments.

I trust this Society, which on account of its numerous branches is so advantageously situated to excite competition and communicate information, will not be the last to patronize chemical and botanical enquiries, or be indifferent to the discoveries in the branches of natural science, the inventors of which will perpetuate their names, and receive the gift of fortune, and honors of posterity.

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